**Pseudo programa**

* Lee info de receta cope y drag
* Lee BOM o info en receta de paso arena por molde
* Usa alturas y peso para calcular tiempos de permanencia en cada mitad
* Aplica coordenadas de receta para rutina de robot

Ejemplo Pattern 6001100

A picture containing indoor, cup, table, kitchen

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Leer info de recetas Cope y Drag

Cope

Table

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Pattern indicates coordinates of the box corners:

|  |  |  |  |
| --- | --- | --- | --- |
| X1= | 88.32 | X2= | 1527.37 |
| Y1= | 548.49 | Y2= | -495.90 |
| H1= | 347.11 | H2= | -345.34 |

Chart, bubble chart

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Length = |1527.374- -88.3224|= 1615.6964

Width = |-495.8964-548.4912| = 1044.3876

Height = Average (|347.11| +|-345.34|) = 346.2226

Drag



Pattern indicates coordinates of the box corners:

|  |  |  |  |
| --- | --- | --- | --- |
| X1= | 96.16 | X2= | 1527.69 |
| Y1= | 551.51 | Y2= | -481.37 |
| H1= | 220.46 | H2= | -220.50 |

Length = |1527.69- -96.16|= 1623.85

Width = |-551.51-481.37| = 1032.88

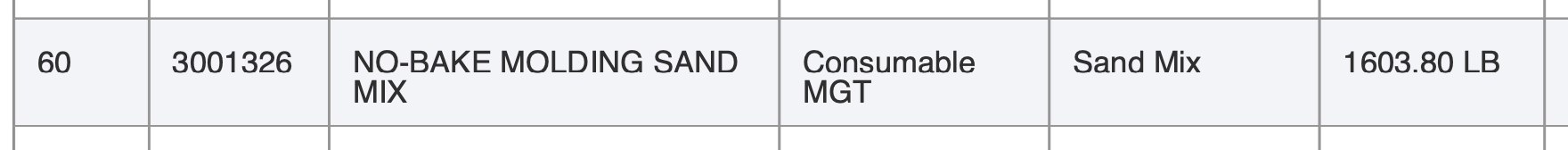
Height = Average (|220.46| +|-220.50|) = 220.48

Lee BOM o info en receta de paso arena por molde

\*\*\*El peso podría ser ingresado a la receta como parte del Teach Mode y así no es necesario tener el BOM a mano en producción.

Table

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Wmold= 1603.8 Lb

Wcope=Wdrag + Wmold

H Height of Cope + Drag

H=Hdrag+Hcope

Wdrag = (H-Hdrag) \* Wmold/H

Wcope = (H-Hcope) \* Wmold/H

Usa alturas y peso para calcular tiempos de permanencia en cada mitad

The areas between Cope and drag are similar but the heights are different. The ratio between their heights determines the fraction of the volume they use. This is only a first approximation because the volume the sleeves, sprue and shapes is not considered. The fractions are:

H = 220.48+346.2226 = 566.7026

%Cope = 100 \* 346.2226/566.7026

%Drag = 100 \* 220.48/566.7026

39% is Drag and 61% cope

Wdrag = 0.39 \* Wmold

Wdrag = 625.5 Lb

Wcope = 0.61 \* Wcope

Wcope = 978.3 Lb

So to determine how long the sand mixer must be applied to either cope and drag is determined by this:

t=W/Q

tcope= 978.3/1500

tcope =0.652 min

tcope = 37.5 sec

tdrag= 625.5/1500

tdrag =0.417 min

tdrag = 25 sec

Aplica coordenadas de receta para rutina de robot

A sand filling program has the following parts:

|  |  |  |  |
| --- | --- | --- | --- |
| Sand Application routine | | | |
| Step | Action | Time Seconds | Time Seconds for 6001100 |
| 1 | Dumping hardened sand into chute | 3 (is not part of overall time) | 3 (is not part of overall time) |
| 2 | Applying sand on sprue and sleeves | 2 sec per item | 6 |
| 3 | Circling around sprue and sleeves | 3 sec per item | 9 |
| 4 | General routine pass 1 | Remaining time / 3 Switch to old sand | 7 |
| 5 | General routine pass 2 | Remaining time / 3 | 7 |
| 6 | General routine pass 3 | Remaining time / 3 | 7 |

En este caso se determinaron 3 cortes verticales pero esto debería ser una variable

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Paso 1 es botar arena en el punto rojo

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Paso 2 es botar sobre cada punto alto

Schematic

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Paso 3 es aplicar arena alrededor de partes altas

Chart, bubble chart

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Paso 4 Se genera una grilla donde se marcan los espacios ocupados por las piezas más altas.

A picture containing table

Description automatically generated

La rutina que llena toda la caja y es repetida para cada corte vertical utiliza la grilla para indicar al robot que se mueva más lento en las áreas verdes.

\*\*\*Variables que hacen que las rutinas sean paramétricas:

* Tiempo de permanencia en cada punto alto
* Cortes verticales
* Radio de giro sobre puntos altos
* Velocidad máxima de robot
* Dimensiones de la grilla
* Offset de trayectorias respecto a paredes de pattern

Secuencia Original.

Chart

Description automatically generated

1. The pattern stops in the second station where the robot takes a picture from the top to identify the position of the calibration strip to acknowledge the pattern configuration.
2. The robot takes the sand tool from the utensil rack and couples it to the sand machine.
3. The robot moves the sand machine head to the dumping chute (red circle) and starts the sand pouring. It dumps the first part to eliminate any hardened material before moving to the pattern.

A picture containing drawing

Description automatically generated

1. The robot moves the head to the pattern and activates the new sand (facing).
2. The machine path is predefined by automatic software using the high sections (sleeve and sprue position) as a start point and then moving around the other sections. This path is repeated for every vertical cut.
3. The vertical cuts have been automatically obtained from an equation that uses the variables: sand flow, robot speed, pattern height (added in the teach mode) and pattern area. The vertical cut may be modified manually if the pattern is not being filled properly.
4. The robot moves the sand machine in one cycle of trajectory using new sand (first vertical cut).
5. The system activates the recycled sand and carries out trajectory cycles until the pattern is full according to the volume vs sand flow, it also has a height sensor to see if the pattern is full
6. Before finishing, it will activate new sand to ensure the next pattern will not use recycled sand in the first stage.
7. For most of the patterns, the vibration actuator is activated for TBD seconds.
8. Robot picks up the striker from the utensil rack
9. Robot uses the striker tool to remove excess sand and pushes it towards chute.
10. Robot leaves striker tool in utensil rack
11. Robot activates the electromagnet tool
12. Robot picks up one metallic lid from the pattern
13. Robot places the metallic lid on the Lid rack
14. Robot repeats the operation according to the program for all the lids.
15. Robot picks up one metallic locator from the pattern
16. Robot places the metallic locator on the locator rack
17. Robot repeats the operation according to the program for all the locators
18. Robot picks up the sprue from the pattern
19. Robot places the sprue on the sprue rack
20. Robot goes to the start position and enters standby mode